



US009207153B2

(12) **United States Patent**
Kim et al.

(10) **Patent No.:** **US 9,207,153 B2**
(45) **Date of Patent:** **Dec. 8, 2015**

(54) **TEST JIG**

USPC 73/760, 856, 860
See application file for complete search history.

(71) Applicant: **LG CHEM, LTD.**, Seoul (KR)

(72) Inventors: **Heung Min Kim**, Daejeon (KR); **Han Sik Kim**, Daejeon (KR); **Seang Hee Chae**, Daejeon (KR)

(73) Assignee: **LG CHEM, LTD.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/519,857**

(22) Filed: **Oct. 21, 2014**

(65) **Prior Publication Data**

US 2015/0090048 A1 Apr. 2, 2015

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2014/005019, filed on Jun. 5, 2014.

(30) **Foreign Application Priority Data**

Sep. 30, 2013 (KR) 10-2013-0116299

(51) **Int. Cl.**

G01N 3/02 (2006.01)

G01N 3/04 (2006.01)

G01N 3/08 (2006.01)

G01N 19/08 (2006.01)

G01R 1/04 (2006.01)

(52) **U.S. Cl.**

CPC .. **G01N 3/04** (2013.01); **G01N 3/08** (2013.01);

G01N 19/08 (2013.01); **G01R 1/0408**

(2013.01); **G01N 2203/0296** (2013.01)

(58) **Field of Classification Search**

CPC .. G01R 1/0408; G01R 1/0466; G01R 1/0483;

G01R 1/07314; G01R 31/26

(56) **References Cited**

U.S. PATENT DOCUMENTS

2002/0017240 A1* 2/2002 Obana et al. 118/712

2004/0020765 A1* 2/2004 Tanaka et al. 204/280

(Continued)

FOREIGN PATENT DOCUMENTS

EP 1 394 874 A1 3/2004

EP 1 770 801 A1 4/2007

(Continued)

OTHER PUBLICATIONS

International Search Report, issued in PCT/KR2014/005019, mailed Sep. 18, 2014.

(Continued)

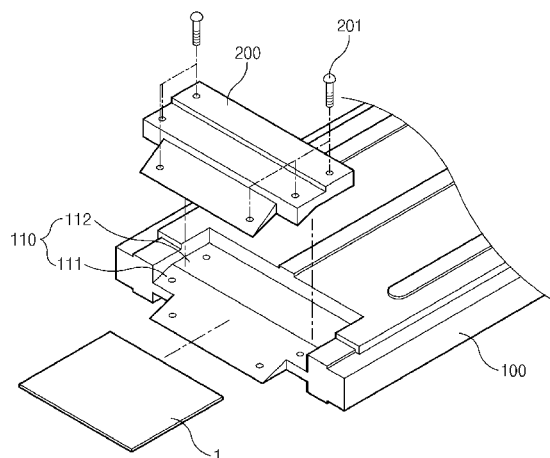
Primary Examiner — Max Noori

(74) *Attorney, Agent, or Firm* — Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

Provided is a test jig including a jig main body having, at an end portion thereof, an insertion part into which an electrode lead is inserted and a fixing member detachably coupled to the insertion part to fix the electrode lead inserted to the insertion part, wherein the insertion part includes insertion faces outwardly extending from both end portions of the jig main body, and coupling faces extending from the insertion faces toward insides of the jig main body and brought into contact with the fixing member, and thus a tensile test is performed on an ultrasonic-welded portion of the electrode lead without an additional cell.

6 Claims, 7 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

2004/0070060 A1* 4/2004 Mamitsu et al. 257/680
 2005/0151550 A1* 7/2005 Lee et al. 324/757
 2008/0054921 A1* 3/2008 Kimura et al. 324/754
 2010/0099021 A1* 4/2010 Oikawa 429/129
 2013/0106453 A1* 5/2013 Ikegami 324/750.19
 2014/0203829 A1* 7/2014 Yamada 324/750.08

FOREIGN PATENT DOCUMENTS

JP 60-64272 U 5/1985
 JP 2011-100643 A 5/2011

JP 2003-331816 A 11/2013
 KR 2001-0104454 A 11/2001
 KR 2001-0109588 A 12/2001
 KR 10-2008-0068305 A 7/2008
 KR 10-2012-0088120 A 8/2012
 KR 10-1242096 B1 3/2013
 KR 10-2013-0065465 A 6/2013

OTHER PUBLICATIONS

Written Opinion of the International Searching Authority, issued in PCT/KR2014/005019, mailed Sep. 18, 2014.
 Supplementary European Search Report in EP 14783759.5 dated Jul. 29, 2015.

* cited by examiner

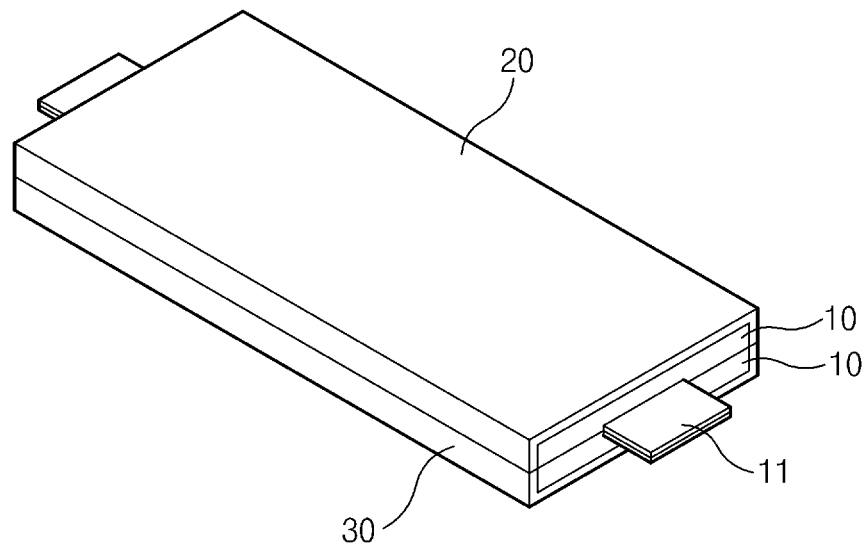


FIG. 1
<Prior Art>

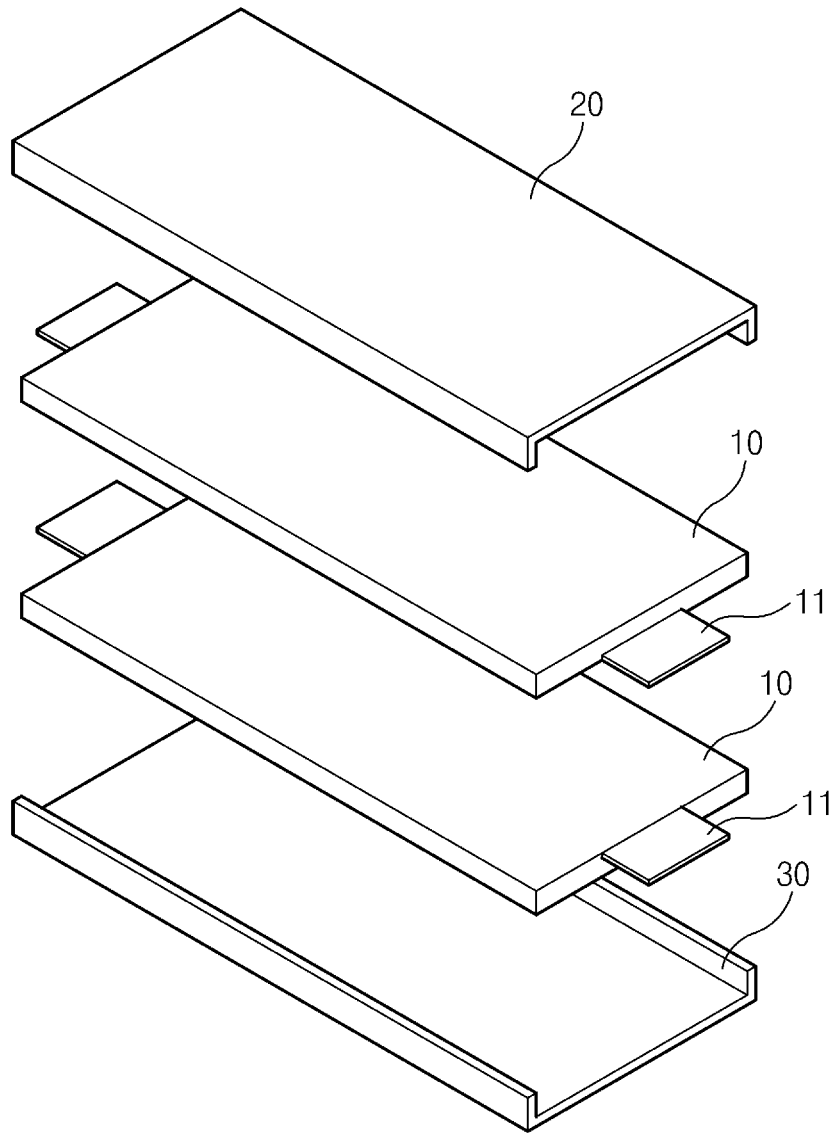


FIG. 2
<Prior Art>

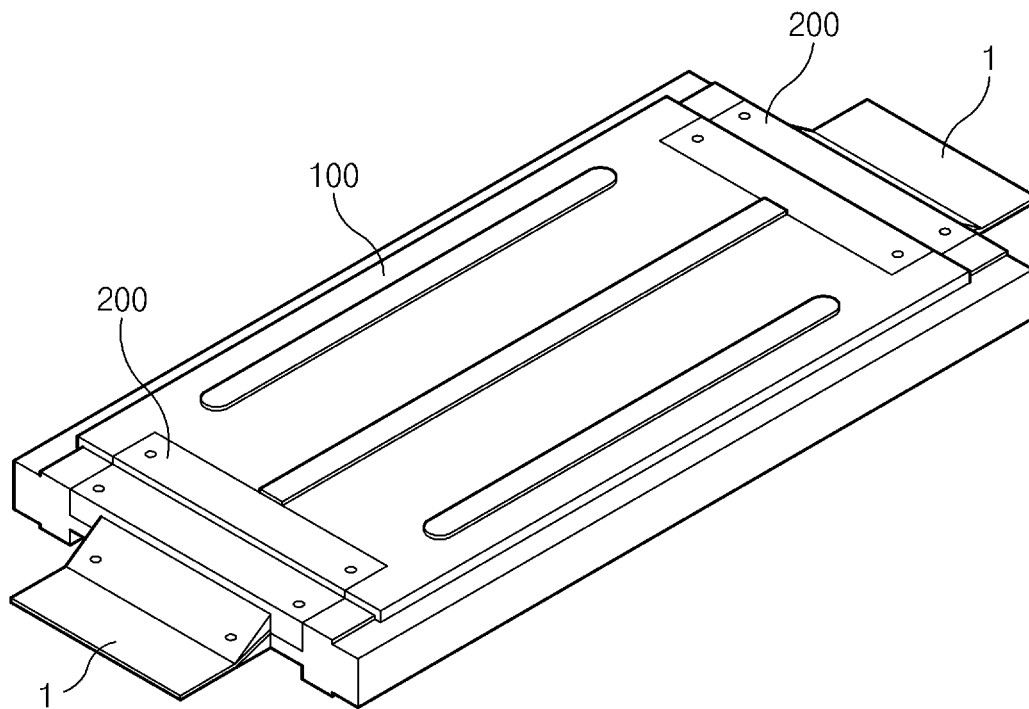


FIG.3

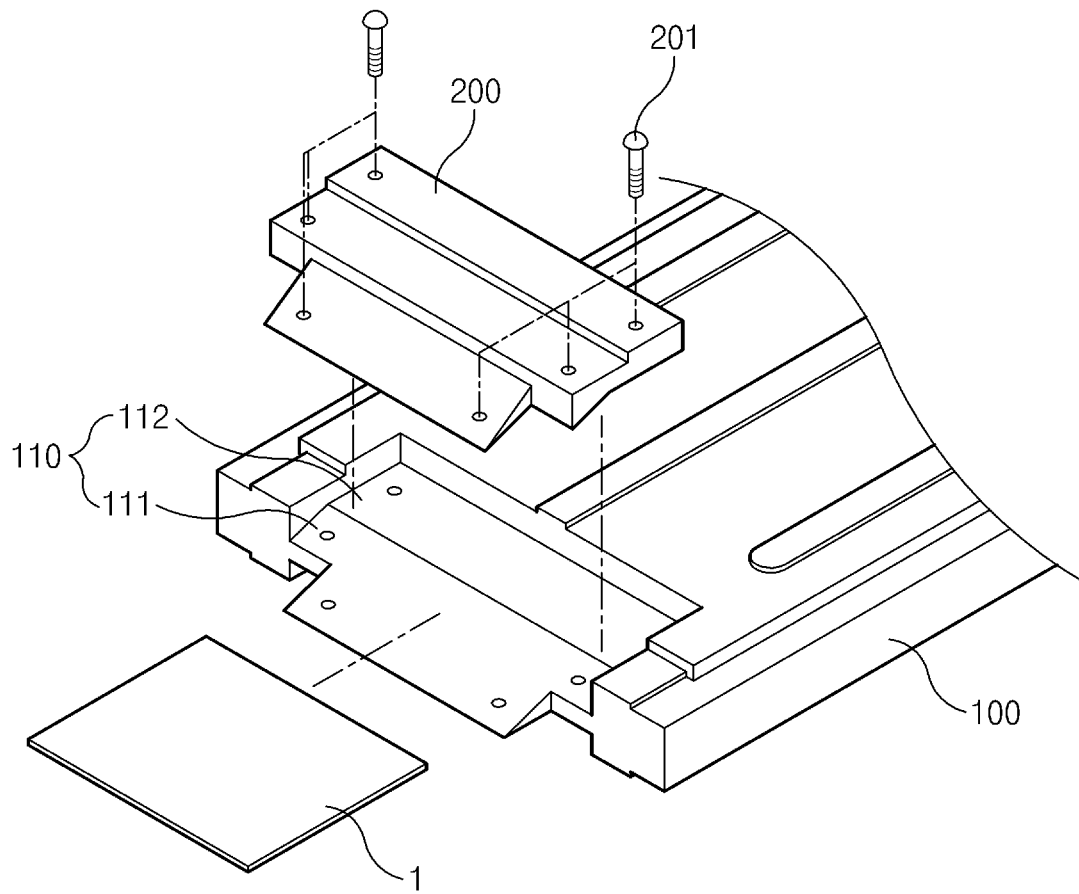


FIG. 4

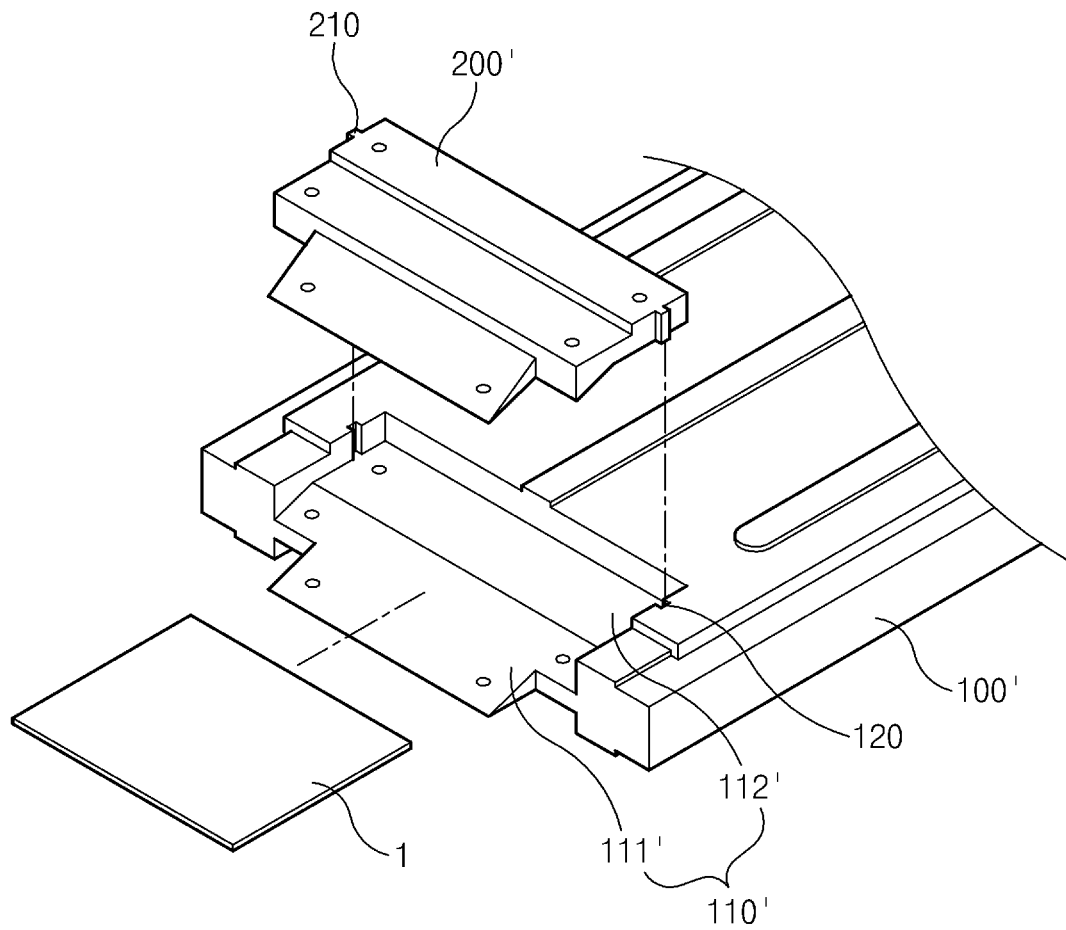


FIG. 5

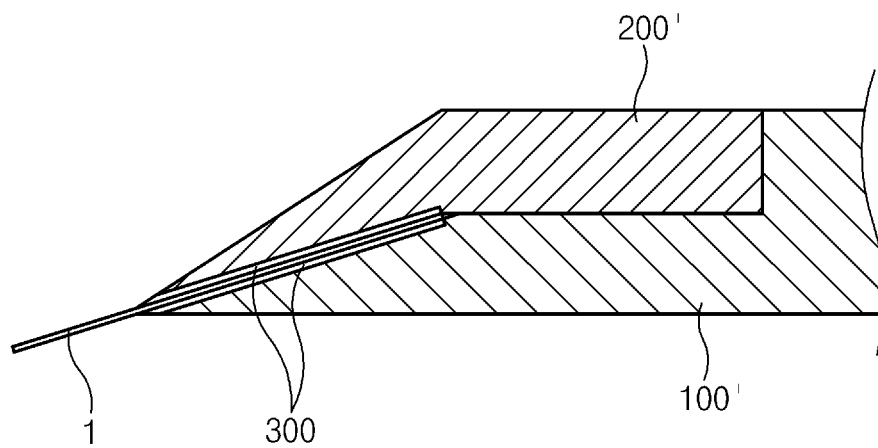


FIG. 6

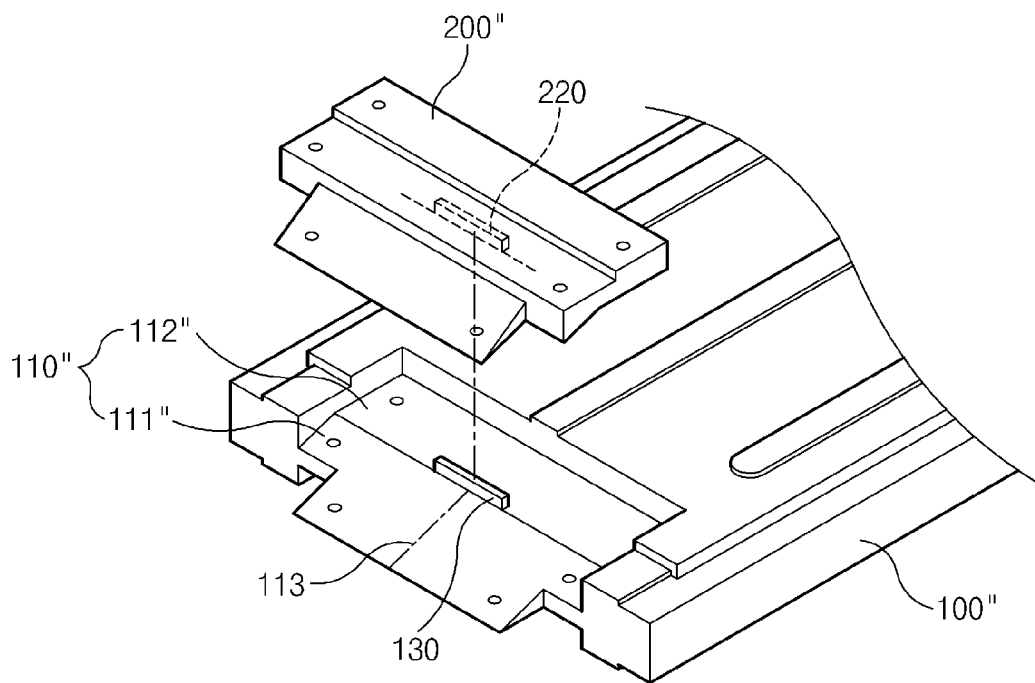


FIG. 7

1

TEST JIG

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a Continuation of PCT International Application No. PCT/KR2014/005019 filed on Jun. 5, 2014, which claims priority under 35 U.S.C. 119(a) to Korean Patent Application No. 10-2013-0116299 filed in the Republic of Korea on Sep. 30, 2013, all of which are hereby expressly incorporated by reference into the present application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a test jig, and more particularly, to a test jig implementing a tensile test for an ultrasonic-welded portion only using an electrode lead without use of a cell.

2. Description of the Related Art

In general, a secondary battery is used in the form of a unit cell and a plurality of unit cells are electrically connected to be used in a form of a battery module. For instance, small-sized devices such as mobile phones may work for a predetermined time with the output and capacity of a unit cell, whereas medium- or large-sized devices such as laptop computers, portable DVDs, small personal computers (PCs), electric vehicles, and hybrid vehicles require a battery module consisting of a plurality of unit cells due to limitations in their outputs and capacities.

The secondary battery is manufactured through a cell assembling process and a battery activation process. In the battery activation process, a cell is mounted on a predetermined jig for a smooth flow of electric current and conditions required for activation, or a tensile test is performed on an ultrasonic-welded portion of an electrode lead of the cell.

Meanwhile, since ultrasonic welding is performed for multiply connecting between a bus bar of the secondary battery and an electrode lead of the cell, the tensile test is performed on the ultrasonic-welded portion, wherein a destructive inspection is performed to measure a tensile force due to the nature of the welding.

Specifically, the tensile test is performed on the ultrasonic-welded portion, as illustrated in FIGS. 1 and 2, in a state where upper and lower jigs 20 and 30 are coupled to an upper part and a lower part of a cell 10 provided with an electrode lead 11, respectively.

However, the secondary battery according to the related art can not reuse the cell provided with the electrode lead 11, which has been subjected to the tensile test, thereby remarkably increasing unnecessary cost.

SUMMARY OF THE INVENTION

An aspect of the present invention provides a test jig which is shaped like a cell and repeatedly usable to perform a tensile test on an ultrasonic-welded portion of an electrode lead, so as to minimize waste of expenses and enhance work efficiency.

According to an aspect of the present invention, there is provided a test jig including a jig main body having, at an end portion thereof, an insertion part into which an electrode lead is inserted and a fixing member detachably coupled to the insertion part to fix the electrode lead inserted to the insertion part, wherein the insertion part comprises insertion faces outwardly extending from both end portions of the jig main

2

body, and coupling faces extending from the insertion faces toward insides of the jig main body and brought into contact with the fixing member.

Meanwhile, the insertion face is inclined outwardly.

A guide protrusion is provided on a side portion of the fixing member, and a guide groove is provided in a sidewall of the insertion part to allow the guide protrusion to be slidably coupled thereto.

Pads having a buffering force are provided on corresponding portions of the insertion part and the fixing member which face each other.

An indicating part indicating a center of the insertion face is provided on the insertion face, so as to place the electrode lead at the center of the insertion face.

A latch part for latching a rear end of the electrode lead is provided on the insertion face, and the latch part is inserted into a latch groove provided in the bottom surface of the fixing member during coupling of the fixing member.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view illustrating a tensile test jig according to a related art;

FIG. 2 is an assembled perspective view illustrating the tensile test jig according to the related art;

FIG. 3 is a perspective view illustrating a test jig according to a first embodiment of the present invention;

FIG. 4 is a partial enlarged perspective view illustrating the test jig according to the first embodiment of the present invention;

FIG. 5 is a perspective view illustrating a test jig according to a second embodiment of the present invention;

FIG. 6 is a cross sectional view of the FIG. 5; and

FIG. 7 is a perspective view illustrating a test jig according to a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Exemplary embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

In a test jig according to the present invention, electrode leads are fixedly inserted into both ends of the test jig, which makes it possible to perform a tensile test on an ultrasonic-welded portion of the electrode lead without using an additional cell, thereby reducing costs and enhancing work efficiency.

Hereinafter, with reference to the accompanying drawings, embodiments of the present invention will be described in detail enough for those of ordinary skilled in the art to easily perform embodiments of the invention. The invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. In the following description of the present invention, a detailed description of known functions and configurations incorporated herein will be omitted to avoid making the subject matter of the present invention unclear and, in every possible case, like reference numerals are used for referring to the same or similar elements in the description and drawings.

According to a first embodiment of the present invention, as illustrated in FIGS. 3 and 4, a test jig into which electrode leads are fixedly inserted includes a jig main body 100 into

which electrode leads **1** are inserted, and a fixing member **200** fixing the electrode leads **1** inserted into the jig main body **100**.

The jig main body **100** is shaped like a cell, and includes insertion parts **110** into which the electrode leads **1** are inserted at both ends thereof, wherein the insertion parts **110** includes insertion faces **111** outwardly extending from the both end portions of the jig main body **100** and supporting the electrode leads **1**, and coupling faces **112** extending from the insertion faces **111** toward insides of the jig main body **100** and brought into contact with the fixing member **200** which will be described later.

As the jig main body **100** is manufactured in the shape of a cell to play a role of the cell, an additional cell is not needed. In other words, it is possible to perform a tensile test on the ultrasonic-welded portion in a state where the electrode leads **1** are inserted into the insertion parts **110** of the jig main body **100**.

The jig main body **100** herein may be manufactured in various shapes in accordance with the size and shape of a cell applied to a battery.

Meanwhile, the insertion face **111** is inclined outwardly, and accordingly the electrode lead **1** is slantly placed to increase work efficiency for the tensile test.

The fixing member **200**, which is provided for fixing the electrode lead **1** inserted into the insertion part **110**, is brought into contact with the insertion part **110** and fixed to the jig main body **100** by using a plurality of bolts **201** as a fixing means.

According to the first embodiment of the present invention, the test jig **100** inserts the electrode lead **1** into the insertion face **111** of the insertion part **110** provided in the jig main body **100**, and then brings the fixing member **200** into contact with the insertion part **110**. Next, the fixing member **200** is fixed to the jig main body by using the plurality of bolts **201** to complete assembly, and then the tensile test is performed on the electrode lead **1** using the assembled test jig.

Therefore, the test jig according to the first embodiment of the present invention does not need to use the additional cell by virtue of the jig main body **100** manufactured in the shape of the cell.

Hereinafter, for convenience of explanation, descriptions for the same or similar configurations or features as those described in the foregoing embodiment shall be skipped.

FIG. **5** is a perspective view illustrating a test jig according to a second embodiment of the present invention.

According to the second embodiment of the present invention, the test jig is configured such that a fixing member **200'** is slidably coupled to an insertion part **110'** by forming a guide protrusion and a guide groove on side portions of the insertion part **110'** of the jig main body **100'** and the fixing member **200'**, respectively.

That is, as illustrated in FIG. **5**, the guide protrusion **210** is provided on the side portion of the fixing member **200'** and the guide groove **120** is provided in the sidewall of the insertion part **110'** to which the guide protrusion **210** is slidably coupled.

Therefore, when the jig main body **100'** and the fixing member **200'** are coupled, the test jig according to the second embodiment of the present invention may efficiently adjust bolt coupling holes to thereby enhance work efficiency and reduce the mobility of the fixing member **200'** to increase a fixing force.

Meanwhile, buffer parts **300** are further provided on corresponding portions of the insertion part **110'** of the jig main body **100'** and the fixing member **200'** which face each other, as illustrated in FIG. **6**. The buffer part **300** is supported by a

surface of the electrode lead **1** to provide a pressing force more uniformly over an entire surface of the electrode lead **1** when coupling the fixing member **200'** to the jig main body **100'**, thereby increasing a fixing force and also preventing the electrode lead **1** from being damaged and from having a tensile force due to the pressing force.

FIG. **7** is a perspective view illustrating a test jig according to a third embodiment of the present invention.

The test jig according to the third embodiment of the present invention, as illustrated in FIG. **7**, includes a latch part **130** disposed at an interface between an insertion face **111"** and a coupling face **112"** of an insertion part **110"** provided on a jig main body **100"**. The latch part **130** may uniformly adjust the heights of the electrode leads **1** by allowing end portions of the electrode leads **1** inserted to the insertion faces **111"** to be latched and thus equally adjust withdrawal lengths of the electrode leads **1** inserted to a plurality of test jigs.

A latch groove **220** into which the latch part **130** is inserted is provided in a bottom surface of the fixing member **200"** and a coupling force is increased by inserting the latch part **130** into the latch groove **220** to bring the fixing member **200"** into contact with the insertion part **110**.

An indicating part **113** is provided at the center of the insertion face **111"** of the insertion part **110"** in a longitudinal direction of the jig main body **100"** and thus the electrode lead **1** may be adjusted to be positioned at the center of the insertion face **111"**, thereby equally adjusting left and right sides of the electrode leads **1** inserted into the plurality of test jigs.

According to the present invention, a tensile test is performed on an ultrasonic-welded portion of an electrode lead without use of an additional cell, thereby minimizing waste of unnecessary costs and enhancing work efficiency.

While the present invention has been shown and described in connection with the exemplary embodiments, it will be apparent to those skilled in the art that modifications and variations can be made without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A test jig comprising:

a jig main body having, at an end portion thereof, an insertion part into which an electrode lead is inserted; and a fixing member detachably coupled to the insertion part to fix the electrode lead inserted to the insertion part, wherein the insertion part comprises insertion faces outwardly extending from both end portions of the jig main body, and coupling faces extending from the insertion faces toward insides of the jig main body and brought into contact with the fixing member.

2. The test jig of claim 1, wherein the insertion face is inclined outwardly.

3. The test jig of claim 1, wherein a guide protrusion is provided on a side portion of the fixing member, and a guide groove is provided in a sidewall of the insertion part to allow the guide protrusion to be slidably coupled thereto.

4. The test jig of claim 1, wherein pads having a buffering force are provided on corresponding portions of the insertion part and the fixing member which face each other.

5. The test jig of claim 1, wherein an indicating part indicating a center of the insertion face is provided on the insertion face, so as to place the electrode lead at the center of the insertion face.

6. The test jig of claim 1, wherein a latch part for latching a rear end of the electrode lead is provided on the insertion

5

face, and the latch part is inserted into a latch groove provided in the bottom surface of the fixing member during coupling of the fixing member.

* * * * *

6